Patent # 1861 A

DIE ATTACH ADHESIVES WITH VINYL ETHER AND CARBAMATE OR UREA FUNCTIONALITY

FIELD OF THE INVENTION

This invention relates to die attach adhesives containing resins that contain both vinyl ether and either carbamate, thiocarbamate or urea functionality.

BACKGROUND OF THE INVENTION

Adhesive compositions, particularly conductive adhesives, are used for a variety of purposes in the fabrication and assembly of semiconductor packages and microelectronic devices. The more prominent uses are the bonding of integrated circuit chips to lead frames or other substrates, and the bonding of circuit packages or assemblies to printed wire boards.

There exist electron acceptor/donor adhesives that contain vinyl ethers as the donor compounds for use in low modulus adhesives, particularly in fast-cure adhesives for die attach applications. However, die attach adhesives containing commercially available vinyl ethers frequently suffer from poor adhesion, resin bleed and voiding due to the volatility and non-polar nature of these commercial vinyl ethers. Thus, there is a need for improved die attach adhesives utilizing vinyl ethers containing polar functionality in order to address these performance issues.

SUMMARY OF THE INVENTION

This invention relates to die attach adhesive compositions containing resins that have vinyl ether and polar functionality, such as a carbamate, thiocarbamate or urea functionality, on a molecular (small molecule) or

Q is an alkyl or alkylenoxy linear or branched chain having 1 to 12 carbon atoms or an aromatic or heteroaromatic ring or fused ring having 3 to 10 carbon atoms within the ring structure, in which the heteroatoms may be N, O, or S;

X and Y are independently O, NR^1, or S, in which R^1 is as described above, with the proviso that both X and Y cannot be oxygen or sulfur, and

Z is a branched or linear alkane, which may contain cyclic moieties, a siloxane. a polysiloxane, a C_1 to C_4 alkoxy-terminated siloxane or polysiloxane, a polyether, a polyester, a polyurethane, a poly(butadiene), or an aromatic, polyaromatic, or heteroaromatic group.

Starting materials for preparation as the Z group are commercially available from a number of sources; for example, aromatic and polyaromatic materials may be obtained from BASF or Bayer; siloxanes and polysiloxanes from Gelest; polyethers from BASF; polyesters from Uniqema or Bayer; poly(butadiene)s from Elf-Atochem; polyurethanes from Bayer or BASF; and the branched or linear alkanes from Uniqema. Some of these sources will have available Z materials already functionalized for reaction with a co-reactive functionality with the starting material containing the vinyl ether group; in other cases, the practitioner will need to functionalize the materials in preparation for reaction with the vinyl ether starting material.

The exact composition or molecular weight of Z is not critical to the invention and can range widely depending on the requirements of the end use for the electron donor compound. The composition of Z can be chosen to give specific material properties in a final formulation, such as, rheological properties, hydrophilic or hydrophobic properties, toughness, strength, or flexibility. For example, a low level of crosslinking and free rotation about polymeric bonds will impart flexibility to a compound, and the presence of